Please type a plus sign (+) inside this box → [+]

PTO/SB/05 (12/97)
Approved for use through 09/30/00. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	95617-USA
Total Pages	15
First Named Inventor or Application Identifier	Erik H. Boch
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. [X] Fee Transmittal Form *(Submit an original, and a duplicate for fee processing)*
2. [X] Specification [Total Pages 11] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [X] Drawing(s) *(35 USC 113)* [Total Sheets 4]
4. Oath or Declaration [Total Pages 2]
   - a. [X] Newly executed (original or copy)
   - b. [ ] Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 17 completed)* *[Note Box 5 below]*
     - i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference *(useable if Box 4b is checked)* The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   - a. [ ] Computer Readable Copy
   - b. [ ] Paper Copy (identical to computer copy)
   - c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [X] Assignment Papers (cover sheet & document(s))
9. [ ] 37 CFR 3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [ ] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
14. [ ] Small Entity Statement(s) [ ] Statement filed in prior application, Status still proper and desired
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Other: .....

17. **If a CONTINUING APPLICATION,** *check appropriate box and supply the requisite information:*
    [ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: _____/_____

18. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [X] *Correspondence address below*

NAME	Marks & Clerk				
ADDRESS	P.O. Box 957, Station B				
	55 Metcalfe Street, Suite 1380				
CITY	Ottawa	STATE	Ontario	ZIP CODE	K1P 5S7
COUNTRY	Canada	TELEPHONE	(613)236-9561	FAX	(613)230-8821

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

PTO/SB/17 (1/98)
Approved for use through 9/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

FEE TRANSMITTAL

Patent fees are subject to annual revision on October 1.
These are the fees effective October 1, 1997.
Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12.

TOTAL AMOUNT OF PAYMENT ($) 830.00

Complete If Known	
Application Number	
Filing Date	
First Named Inventor	Erik H. Boch
Examiner Name	
Group / Art Unit	
Attorney Docket No.	95617-USA

METHOD OF PAYMENT (check one)

1. ☐ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 13-1717
Deposit Account Name:

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17 ☐ Charge the Issue Fee Set in 37 CFR 1.18 at the Mailing of the Notice of Allowance

2. ☒ Payment Enclosed: ☒ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	790	201	395	Utility filing fee	790
106	330	206	165	Design filing fee	
107	540	207	270	Plant filing fee	
108	790	208	395	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 790.00

2. EXTRA CLAIM FEES

	Extra Claims		Fee from below	Fee Paid
Total Claims	18 -20** =	0	X	0
Independent Claims	3 - 3** =	0	X	0
Multiple Dependent				

***or number previously paid, if greater; For Reissues, see below*

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	22	203	11	Claims in excess of 20
102	82	202	41	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	82	209	41	** Reissue independent claims over original patent
110	22	210	11	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	950	217	475	Extension for reply within third month	
118	1,510	218	755	Extension for reply within fourth month	
128	2,060	228	1,030	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,320	241	660	Petition to revive - unintentional	
142	1,320	242	660	Utility issue fee (or reissue)	
143	450	243	225	Design issue fee	
144	670	244	335	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	40
146	790	246	395	Filing a submission after final rejection (37 CFR 1.129(a))	
149	790	249	395	For each additional invention to be examined (37 CFR 1.129(b))	

Other fee (specify) _____

Other fee (specify) _____

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 40.00

SUBMITTED BY

				Complete (if applicable)	
Typed or Printed Name	George M. MacGregor			Reg. Number	37547
Signature		Date	10/15/98	Deposit Account User ID	

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

Cellular Base Station With Integrated Multipoint Radio Access and Intercell Linking

Field of the Invention

This invention relates to a cellular, broadband wireless system for use in providing radio access to a large geographic area and more particularly to a radio interface system at a cellular, multipoint base station that can provide scalable, broadband radio access to multiple customer sites and simultaneously provide scalable point to point radio interconnect between cells.

Background

Broadband wireless systems, such as Local Multipoint Delivery/Communication Systems (LMDS/LMCS), represent an effective implementation whereby small and medium sized businesses are able to connect to the ATM backbone without the need for dedicated terrestrial cabling. A LMCS/LMDS typically has a base station connected to the ATM backbone, the base station having a transceiver for point to multipoint communication with network interface units (NIUs) located at customer sites, usually fixed, within a cellular area.

Typically, a base station is located centrally within a substantially circular cellular area. To make better use of the range of radio frequencies which may be licensed to a service provider, and to provide greater coverage, a cell is frequently divided into sectors (for example four sectors each covering 90 degrees) with a sectored antenna operating in each sector.

Network interface units (NIUs) are located at customer sites within each sector and have means for receiving transmission from the base station by way of a point to multipoint protocol. The NIUs connect to customer premise equipment (CPE) via T1 or Ethernet links, for example. Additionally, each NIU will have a highly directional antenna pointed at the base station for bi-directional communication therewith by way of a point to point protocol.

A large metropolitan area will typically be covered by a number of adjacent (overlapping to some degree) cells each having a base station for communicating with customer sites within each cell. Generally, cellular radio access systems used for fixed, bi-directional radio access are interconnected to form a network using radio-based intercell linking or other suitable alternatives such as fiber optics or copper wire. In this way the coverage provided to the metropolitan area can be coordinated

Traditionally, the multipoint radio access system and the radio intercell links (so called point-to-point radios) were essentially two separate systems. . In a radio based intercell link implementation a service provider typically obtains a license for a fixed frequency or frequency spectrum and then uses transmission equipment tuned to a licensed frequency. Therefore, the point-to-point radios for intercell linking are fixed bandwidth units and do not significantly scale in their capacity.

Summary of the Invention

The subject of this invention is the architecture of a cellular, multipoint base station which can provide scaleable, broadband radio access to fixed customer sites and simultaneously provide scaleable point-to-point radio interconnect between the cells, thereby forming a cellular-type network with ubiquitous coverage of a predetermined service area, nominally requiring more than one cell.

Therefore, in accordance with a first aspect of the present invention there is provided in a cellular, broadband wireless digital network an interface system at a base station for providing bi-directional, point to multipoint access to network interface units at customer sites within a cellular area and point to point bi-directional radio access to a base station unit in an adjacent cellular area.

In a preferred embodiment a large geographic area is covered by a plurality of overlapping cells each having a base station for communicating with fixed customer sites within each cell. A

designated base station is controlled by a network manager (which normally also manages many other network components) and is in bi-directional communication with the other base stations by way of radio based intercell links. ATM Radio Interface Cards (ARICs) at the base stations are used to provide point to multipoint communication with NIUs and point to point radio communication using intercell links between base stations. The capacity of the system both with respect to customer sites and intercell links is scaleable by increasing or decreasing the number of ARICs.

In accordance with a second aspect of the invention there is provided a method of providing scaleable, broadband wireless access to a large geographic area comprising: dividing the geographic area into cellular areas; providing a base station within each cellular area; and providing at least two ATM Radio Interface Cards (ARICs) at each base station, one of the ARICs for communicating with Network Interface Units (NIUs) within the cellular area and another one of the ARICs for providing radio access to ARICs in other base stations.

Brief Description of the Drawings

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

Figure 1 is a high level diagram of an ATM wireless system having a network manager and linked base stations in respective cells;

Figure 2 illustrates a cell array having ringed, bi-directional intercell radio links

Figure 3 illustrates a cell array having meshed, bi-directional intercell radio links;

Figure 4 illustrates the architecture of an ATM based Multipoint base station used to provide fixed, broadband wireless access;

Figure 5 shows a typical four sectored cell structure used to create a circular cell coverage area;

Figure 6 illustrates overlapped cells used to provide coverage to a selected service area such as a metropolitan area; and

Figure 7 shows the architecture of an ATM based wireless access base station able to provide scaleable, integrated multipoint access and intercell link functionality.

Detailed Description of the Invention

Figure 1 illustrates, at a high level, a broadband, ATM-based wireless system. As shown in this implementation, an array of overlapping cells 10 provide coverage to a metropolitan area. Each cell 10 is subdivided into sectors 11 with a central base station 13. Network Interface Units 14 at customer sites have transceivers for communicating with the base station over wireless links. As shown in Figure 1 one of the base stations 15 is connected to the ATM network 16 and may also be connected to other networks such as the Public Switched Telephone Network 17 or Internet 18. Additionally, one of the base stations such as base station 15 is connected to a network manager 19 for the purpose of coordinating services to the cell array. In the implementation of Figure 1 base station 15 is connected to each of the other base stations 13 via intercell links 21, which may be, for example, optical fiber or, according to the present invention, radio links.

Typically, communication between each base station 13 and associated NIUs 14 within each sector utilizes a point-to multipoint protocol while communication from each NIU 14 to the cellular base station is by point-to point protocol. Customer premise equipment (not shown) at customer sites are linked to the NIUs and provide access to the ATM network 16.

The intercell links for bi-directional radio communication, according to the present invention, can be implemented, for example, in a ringed or meshed configuration. An example of a ringed configuration is shown in Figure 2 wherein one of the base stations 32 is connected to the ATM network 16 and the network

manager 19. Each of the other base stations 34 is in bi-directional communication with base station 32 over intercell radio links 36.

An example of a meshed configuration is illustrated in Figure 3. In this example base station 40 is connected to the ATM network 16 and to the network manager 19. Bi-directional communication between the remaining base stations 44 is conducted via links 42. In this example and in the example of Figure 2 it is to be understood that any of the base stations can be configured to have direct access to the ATM network and/or the network manager.

The base station architecture is based on Asynchronous Transfer Mode (ATM) functionality which houses circuit card assemblies, known herein as ATM Radio Interface Cards (ARICs) 23, which provide connectivity to customer sites, usually fixed, within the coverage area. In a preferred embodiment of the invention the ARICs 23 are installed in an ATM multi-services switch at the base station. An example of a multi-services switch is a Newbridge 36170.

The ARICs 23, as will be discussed later, provide service to both the multipoint radio access system and the radio intercell links. In a particular implementation of the multipoint radio aspect of the invention a time division multiple access (TDMA) ARIC provides downlink point to multipoint communication while frequency division multiple access (FDMA) ARICs provide the uplink, point to point access. According to the present invention FDMA ARICs are also used for the intercell radio links. Reference may be made to Applicant's co-pending Canadian patent application filed July 9, 1998 and entitled Radio Interface Card for a Broadband ATM System (Agent's Docket 95527) for greater detail respecting the ARIC The contents of the aforementioned Canadian application are incorporated herein by reference.

Figure 4 shows the system architecture according to the present invention. Essentially the ARIC card circuitry in the base station 51 provides the interface between the multipoint radio access functionality operating within the sector(s). As shown in Figure 4 the ARIC cards 23 are connected to outside

receivers/transmitters 50, 52 by way of combiners 54. Typically 4 sectors 11 would be implemented to provide a circular (i.e. 360 degrees) cell as shown in Figure 5. In a metropolitan application where the total coverage area is greater than the area covered by a single cell (a cell may have a 2 – 3 km radius, for example) multiple cells are overlapped to provide a larger coverage area as shown in Figure 6.

As shown in Figure 6 each cell, according to this embodiment of the invention, has a base station 60 operating a sectored antenna 62 for communicating with NIUs 64 within respective sectors 66. As demand for service within each sector (and/or cell) increases ARIC cards are added to respective base stations to increase the capacity of each base station in a quasi-linear fashion. Typically, the amount of digital data which is switched out of the base station and sent to other parts of the network, for example the backbone or Wide Area Network (WAN), also increases with increasing capacity in the multipoint access layer of the network. As a result of this capacity relationship it is highly desirable to implement a scaleable capacity solution for both the Multi-Point Access layer as well as the WAN layer of the system. It is further desirable to implement both the Multi-Point base station and radio based Intercell Links (so called ICLs) from a single base station entity which can be remotely managed by a network manager 19 (Newbridge 46020, for example) in an integrated fashion. The network manager 19, in an exemplary embodiment, configures the operating frequencies, establishes the modulation rate, is responsible for the desired forward error correction (FEC) values and sets transmission power levels.

Figure 7 shows the architecture of a base station 70 for implementing the aforementioned integrated system. In this architecture the TDMA/FDMA ARIC cards 23 are used, along with ATM signal switching/routing, to achieve a wireless base station with an integrated ability to provide multi-point access to fixed customer sites as well as providing FDMA ARICs for the ICL functionality. In both cases the architecture is scalable through adding the appropriate ARIC modules. This integrated and scalable solution results in a high degree of performance and cost effectiveness, since capacity is added only as required.

As shown in Figure 7 the ARIC cards 23, combiner 54 and transceivers 50, 52 previously shown in Figure 4 in relation to an ATM-based wireless base station are the same. One or more additional FDMA ARICs are incorporated in the system shown in Figure 7 to provide access to the intercell radio link. The ICL ARIC(s) are connected to high gain (for example 36 to 42 dB) intercell link antennas 70 via the combiner 24. In addition to the high gain, (36 to 42 dB compared to 21 db for sectored antennas, for example) the intercell link antennas provide improved directionality.

In an embodiment of the invention the carrying capacity of the intercell link is 155 mb/s, i.e. OC-3 capability. The intercell link carries aggregate traffic between base stations including control traffic and user data traffic. In accordance with the invention a selected or designated base station is in bi-directional communication with base station(s) in one or more adjacent cellular areas. Also, as indicated previously, one of the base stations is remotely managed by a network manager to provide coordinated services throughout the large geographic area. Each of the base stations in adjacent cells, however, has a communication link to the network manager via the designated or selected base station.

Although a particular embodiment of the invention has been illustrated and described it will be apparent to one skilled in the art that numerous variations and alterations can be implemented without departing from the basic concept. It is to be understood, however, that such variations and alterations will fall within the scope of the invention as defined by the appended claims.

Claims:

1. **In a cellular, broadband wireless digital network an interface system at a designated base station for providing bi-directional, point to multipoint access to network interface units (NIUs) at customer sites within a cellular area and point to point bi-directional radio access to an auxiliary base station in an adjacent cellular area.**

2. **An interface system as defined in claim 1 wherein said broadband wireless network is an asynchronous transfer mode (ATM) system.**

3. **An interface system as defined in claim 2 comprising an ATM Radio Interface Card (ARIC).**

4. **An interface system as defined in claim 3 wherein said ARIC in said designated base station is controlled by a network manager.**

5. **An interface system as defined in claim 1 wherein said NIUs are at customer sites which are at fixed locations within said cellular area.**

6. **An interface system as defined in claim 5 wherein time division multiple access (TDMA) ARICs are provided for communication from said base station to said NIUs and frequency division multiple access (FDMA) ARICs are provided for communication from said NIUs to said base station.**

7. **An interface system as defined in claim 3 wherein frequency division multiple access (FDMA) ARICs are provided for bi-directional intercell radio communication.**

8. **A system for providing broadband wireless communication over a large geographic area comprising: a plurality of overlapping cellular areas each having a base station with a transceiver for bi-directional communication with network interface units (NIUs) within each cellular area; and ATM**

Radio Interface Cards (ARICs) at each base station for bi-directional communication with said NIUs in said cellular area and for point to point communication with ARICs in other base stations.

9. A system as defined in claim 8 having at least one time division multiple access (TDMA) ARIC for point to multipoint communication from said base station to said NIUs and at least one frequency division multiple access (FDMA) ARIC for point to point communication from said NIUs to said base station.

10. A system as defined in claim 8 having a frequency division multiple access (FDMA) ARIC for bi-directional intercell radio communication between base stations.

11. A system as defined in claim 8 wherein one of said base stations is in communication with a network manager for controlling said system.

12. A system as defined in claim 9 wherein additional ARICs are implemented to increase coverage within each cell.

13. A system as defined in claim 10 wherein additional ARICs are implemented to communicate with additional base stations in adjacent cellular areas.

14. A method of providing scaleable, broadband wireless access to a large geographic area comprising: dividing said geographic area into cellular areas; providing a base station within each cellular area; and providing ATM Radio Interface Cards (ARICs) at each base station, for communicating with Network Interface Units (NIUs) within said cellular area and for providing radio access to ARICs in base stations in other cellular areas.

15. A method as defined in claim 14 wherein time division multiple access (TDMA) ARICs and frequency division multiple access (FDMA) ARICs are provided for bi-

directional communication between said base station and and NIUs within a cellular area.

16. A method as defined in claim 15 wherein FDMA ARICs are provided in said base stations for bi-directional intercell radio communications.

17. A method as defined in claim 16 wherein one or more of said base stations is provided with access to a network manager.

18. A method as defined in claim 14 wherein said broadband wireless access is scaleable by increasing the number of ARICs at selected base stations.

Abstract

A scaleable, broadband wireless system for providing radio access to a metropolitan area. The metropolitan area is sub-divided into overlapping cellular areas each having a base station for communication with network interface units at customer sites within each cell. ATM Radio Interface Cards (ARICs), both time division multiple access (TDMA) and frequency division multiple access (FDMA), in each base station implement protocols for bi-directionally linking the NIUs with the ATM backbone. FDMA ARICs provide point to point radio access between base stations over intercell links. The capacity of the system can be scaled by adding the appropriate ARICs as required to meet demand.

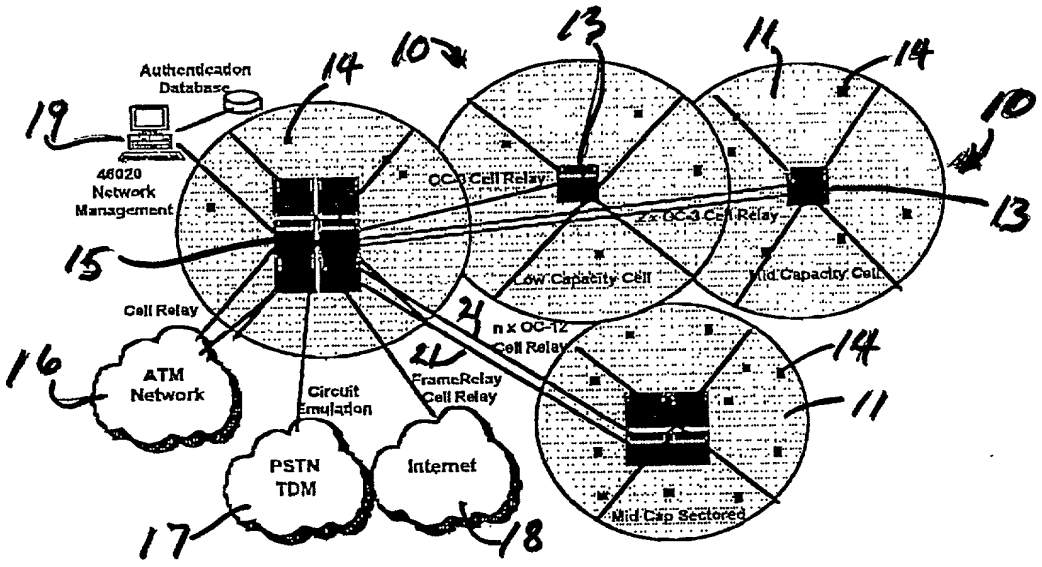

FIGURE 1

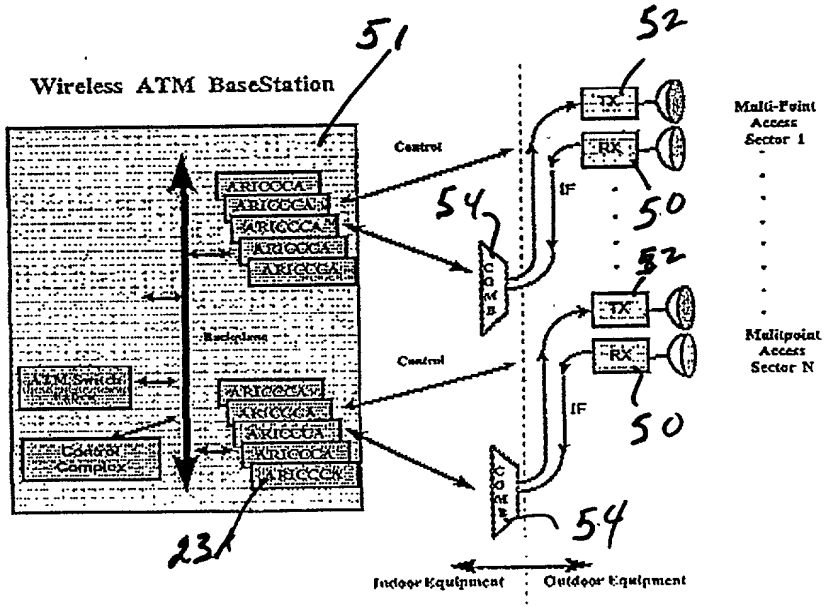

FIGURE 4

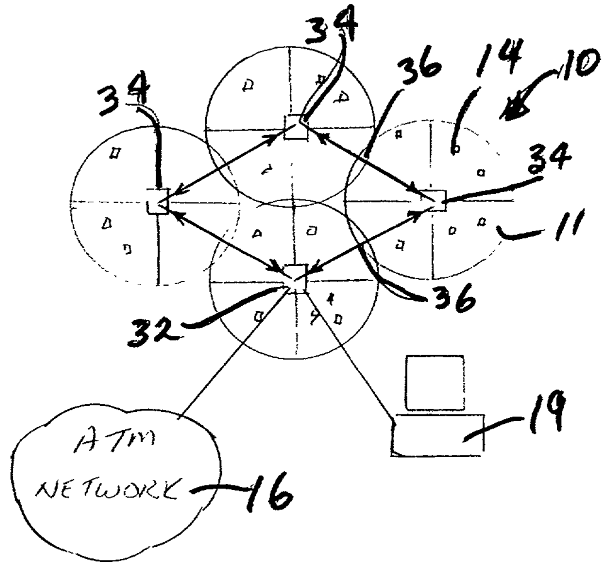

FIGURE 2

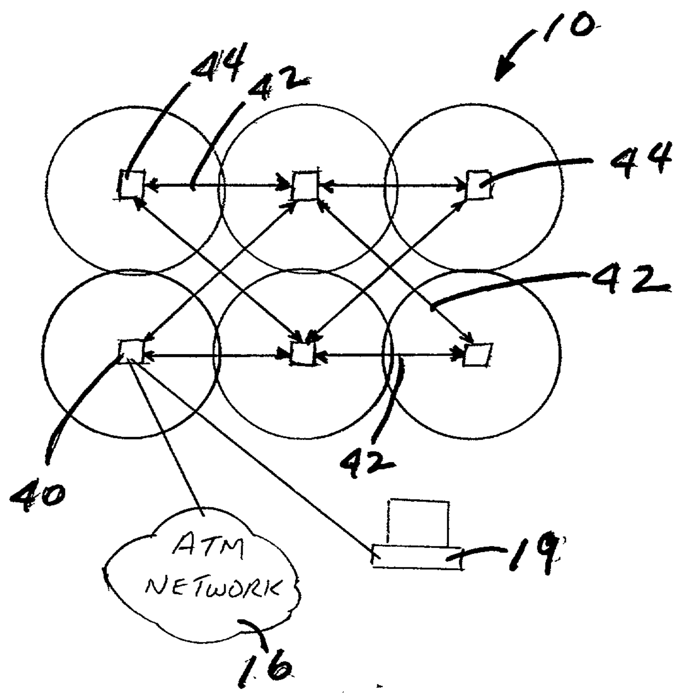

FIGURE 3

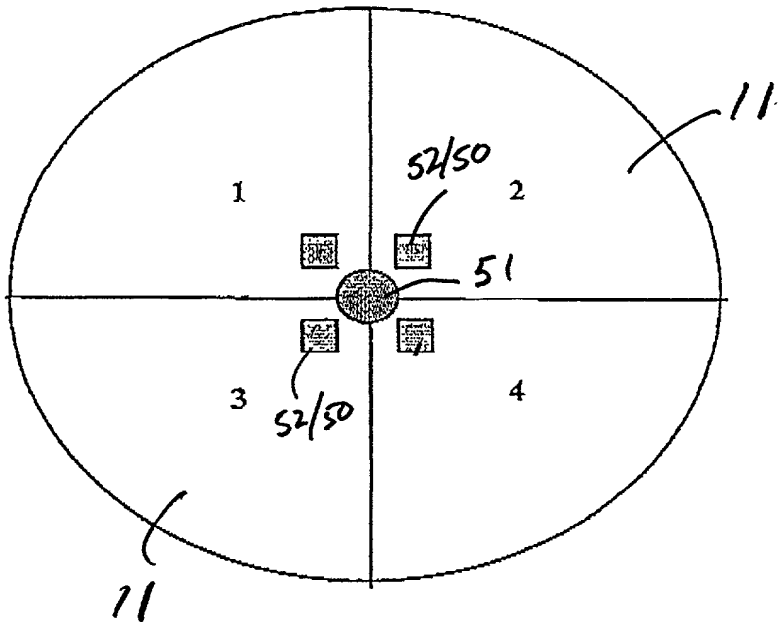

FIGURE 5

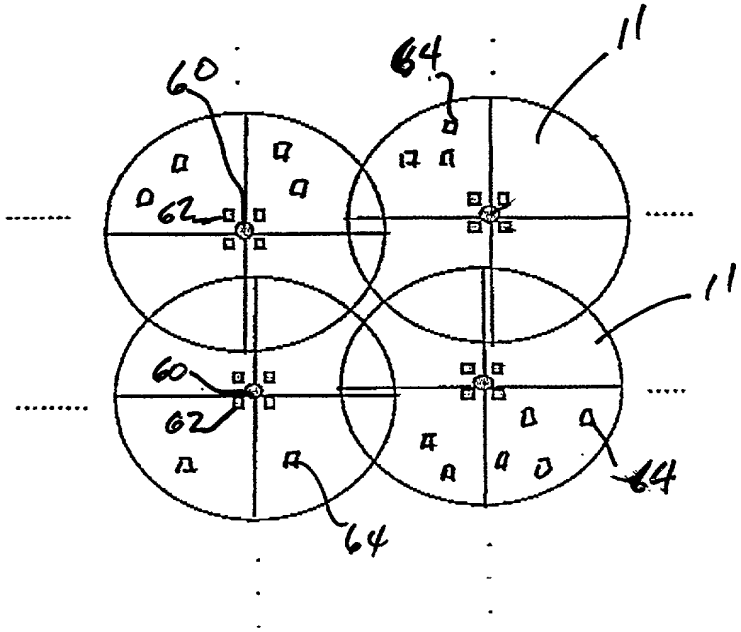

FIGURE 6

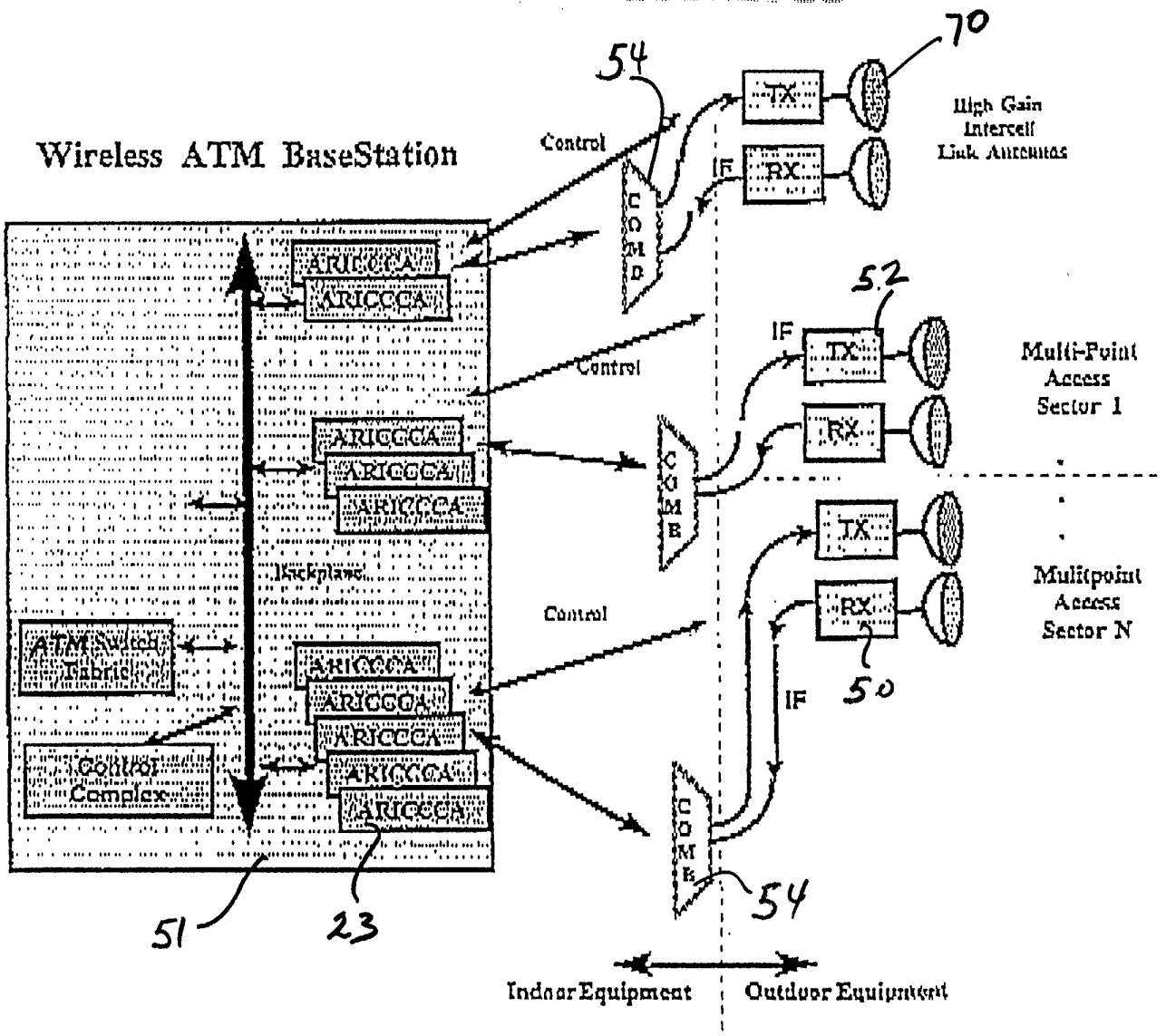

FIGURE 7

USA

Agent's Docket No. **95617-US**

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) for the subject matter which is claimed and for which a patent is sought on an invention entitled

CELLULAR BASE STATION WITH INTEGRATED MULTIPOINT RADIO ACCESS AND INTERCELL LINKING

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, ss1.56(a).

I hereby claim priority rights under Title 35, United States Code ss119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):			Priority claimed
			No
(Number)	(Country)	(Day/Month/Year)	

I hereby claim the benefit under Title 35, United States Code, ss120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, ss112, I acknowledge the duty to disclose material information as defined in title 37, Code of Federal Regulations, ss1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	(Filing date)	(Status)

I hereby appoint the following agents to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

George M. MacGregor, Reg. No. 37,547

Richard J. Mitchell, Reg. No. 34,519

Paul S. Sharpe, Reg. No. 39,493

Direct all telephone calls to Tel: **(613) 236-9561**

Address all correspondence to: **MARKS & CLERK, 55 Metcalfe Street, Suite 1380, P.O. Box 957, Station B, Ottawa, Ontario Canada K1P 5S7**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued

thereon.

<u>Inventor</u>

Full name: **Erik H. BOCH**
Citizenship: Canadian Residence (City, State): Stittsville, Ontario, Canada

Address: **35 Crantham Crescent, Stittsville, Ontario, K2S 1R2, Canada**

Signature: [signature] Date: Oct 5/98

Erik H. BOCH

<u>Inventor</u>

Full name: **Alan JAAKKOLA**
Citizenship: Canadian Residence (City, State): Kanata, Ontario, Canada

Address: **1350 Nadia Lane, Kanata, Ontario, K2W 1A5, Canada**

Signature: [signature] Date: Oct 13/98

Alan JAAKKOLA

<u>Inventor</u>

Full name:
Citizenship: Canadian Residence (City, State): Canada

Address:

Signature:.................................... Date:..............................

<u>Inventor</u>

Full name:
Citizenship: Canadian Residence (City, State):Canada

Address:

Signature:.................................... Date:..............................